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MALLOPHAGAN PARASITES FROM INDIAN BIRDS—PART V.[1] SPECIES BELONGING TO THE GENUS *IBIDOECUS* CUMMINGS, 1916 (ISCHNOCERA)

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With 26 Text-figures

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I. Introduction

Species of the genus *Ibidoecus* Cummings, 1916 are normally parasitic on members of the avian family Threskiornithidae, but recently Carriker (1947) has also reported two subspecies from as many subspecies of *Aramus scolopaceus* (Gmelin) (Aramidae).

In the Indian and Ceylonese subregions and Burma five hosts of *Ibidoecus* occur—a spoonbill and four ibises. Ischnoceran parasites of the Spoonbill, *Platalea l. leucorodia* L., the Black-Headed Ibis, *Threskiornis melanocephala* (Latham) and the Glossy Ibis, *Plegadis f. falcinellus* (Linn.), have long been known; only the Black Ibis, *Pseudibis papillosa* (Temminck) and Davison's Black Ibis, *Pseudibis davisoni* (Hume), remained to be examined. A good series of *Ibidoecus* from *P. papillosa* has proved to belong to a new species. Only one female was available from *P. davisoni* (slide no. 4905, Meinertzhagen collection, British Museum (Nat. Hist.)); this differs from the species described in this paper, and is nearest to *Ibidoecus dennelli* sp. n. It is undoubtedly a new species but it has not been considered judicious to describe it on the basis of the single female but to wait until a good series consisting of both sexes is available.

[1] Part IV in this series appeared in *Ann. Mag. nat. Hist.* (12) 8 : 417–33, 1955.

In the most recent check-list of the Mallophaga of the World (Hopkins and Clay, 1952) 23 species are included in this genus, of which 18 are considered to be valid. In 1947 the genus was reviewed by Carriker who, besides describing five new Neotropical forms, also included a key and short notes on the known species. The following valid species were not included by Carriker:

acutulus (Neumann), 1922
clausus (Giebel), 1874
robustus Qadri, 1935
vicinus (Neumann), 1922

Of these *robustus* Qadri was described from India (without host), *clausus* (Giebel) from *Threskiornis melanocephala* and *acutulus* (Neumann) and *vicinus* (Neumann) from Ethiopian ibises.

An examination of authentic material from *Threskiornis melanocephala*, *Plegadis f. falcinellus*, *Pseudibis papillosa* and *Platalea l. leucorodia* has shown that each ibis has its own distinct *Ibidoecus* species. As *robustus* Qadri was described from a female and its true host not known, it is intended to determine the host, if possible, and decide the status of this species.

Furthermore, as no adequate descriptions or figures for the identification of *clausus* (Giebel), *bisignatus* (Nitzsch) and *plataleae* (Denny), from *T. melanocephala*, *P. f. falcinellus* and *P. l. leucorodia* respectively, are available, opportunity is now taken to provide these; keys for both the sexes have also been devised. Only *I. dennelli* sp. n., from *P. papillosa*, has been described in detail; for the remaining species only the more important characters have been given.

ACKNOWLEDGMENTS

I am indebted to Dr. Theresa Clay of the British Museum (Nat. Hist.) who with her customary kindness lent the material required for this study, gave much valuable advice and permission to quote from unpublished work, and to Professor M. B. Lal of this department for encouragement and continued interest in my work.

II. THE GENUS *Ibidoecus* CUMMINGS, 1916

Ibidoecus Cummings, 1916, *Proc. zool. Soc. Lond.* **1916**: 663.

Type species: *Philopterus plataleae* Denny, 1842,

The genus *Ibidoecus* is readily recognised by the characters of the pre-antennal region of the head. The dorsal anterior plate is in the form of two separate plates, the posterior margin of each of which is produced as a heavily sclerotised, thickened point over the pre-antennal suture. The plates are either with or without oblique, parallel thickenings apically. Other characters of secondary importance are the mandibles; the outermost, spine-like seta on each side of the posterior margin of the pterothorax; the tergal plates on abdominal segment II (apparent first abdominal segment) of which the anterior margin is variously modified, and the heavily sclerotised and pigmented prominent sternites thereon; and the chaetotaxy of sternum II which consists of only two minute setae, located in the middle of the segment.

Carriker (1947) observed that the three species from the Plataleinae : *plataleae* (Denny), 1842, *flavus* Cummings, 1916 and *iberoamericanus* Eichler, 1943 (= *ajajus* Carriker, 1947), formed a homogeneous group which differs from the other group comprised by the remaining species from the ibises. The characters, according to Carriker, which set the three species apart are the pterothoracic structure and male genitalia, the latter considered to be extremely complex.

This study, even though it is based on fewer species than Carriker's—one spoonbill *Ibidoecus* and three from ibises—leaves no doubt that the first differs considerably from species from the latter hosts, but the distinguishing characters do not agree with those proposed by Carriker. The striking differences are, in the male, in the arrangement of the tergites on the terminal abdominal segment (XI) and, in the female, in the relation of the sternal thickening on abdominal segment VII to the genital plate and the characters of the lateral sclerites which reinforce the vulva on each side.

From the accounts and figures of *flavus* Cummings (Cummings, 1916 : 665) and *iberoamericanus* Eichler (Eichler, 1943 : 5 and Carriker, 1947 : 118) it is evident that these species too possess the aforesaid diagnostic characters, in common with *plataleae* (Denny). These characters have proved to be valuable key characters for separating species of *Ibidoecus* on the spoonbills (subfamily Plataleinae) from those on the ibises (subfamily Threskiornithinae).

III. The Species of *Ibidoecus* Cummings

(1) **Ibidoecus dennelli** sp. n. (Figs. 1–4, 8, 12, 13, 17)

Type host : *Pseudibis papillosa* (Temminck).

Material examined.—Five males and six females from the Black Ibis, *Pseudibis papillosa* from U.P., India, and one male and one female from the same host, slide no. 4904 in the Meinertzhagen collection, British Museum (Nat. Hist.), from North India.

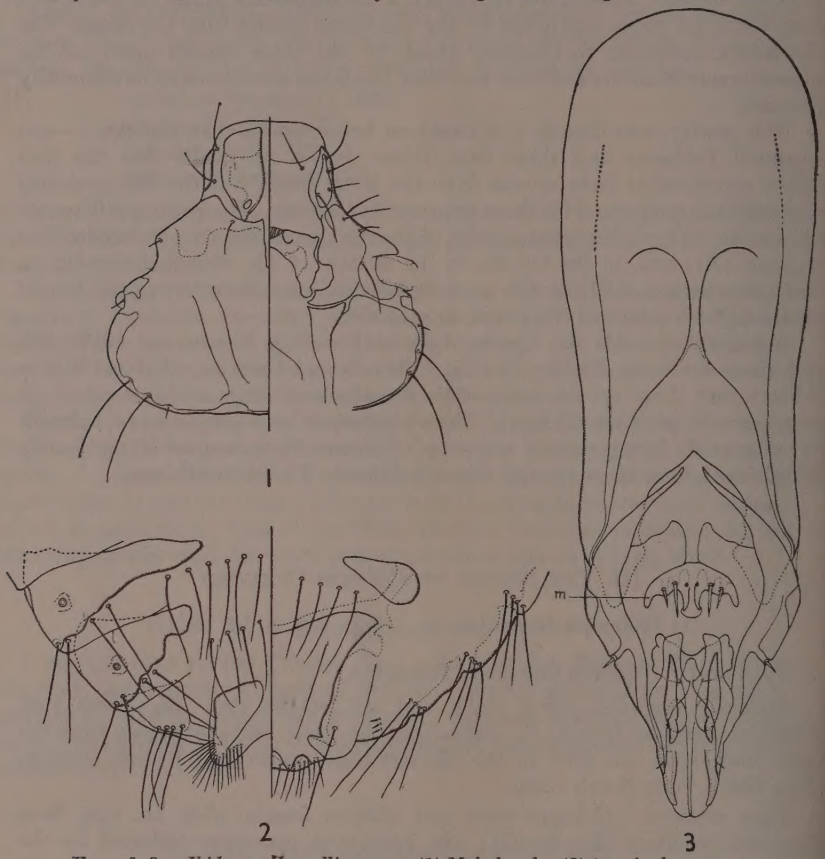
Type material.—*Holotype* male and *allotype* female, slide no. 616, from *Pseudibis papillosa* (Temminck) ; the types and paratypes collected by the author have been presented to the British Museum (Nat. Hist.).

Male.—General characters and shape of head as shown in figure 1 ; breadth at temples greater than total length ; C.I. 1·08–1·11 (Tables IV and VI). The divided dorsal anterior plate without oblique, parallel thickenings apically. Setae in pre-antennal region long, with the exception of preconal and preantennal setae which are short ; 4 long and 2 short marginal temporal setae ; occipital setae short ; mandibles characteristic, as admirably described for *plataleae* by Cummings (1916 : 664).

Prothorax with slightly divergent sides ; pronotum divided in the middle, but joined to a median plate ; 2 setae each side on posterior margin, the outer placed below the level of the prothoracic spiracle.

Pterothorax large, with strongly divergent sides ; pteronotum completely divided in the middle. Mesonotum without setae. Setae present on postero-lateral and posterodorsal margins, those on the latter extending to the mid-line ; total number of setae each side varies between 14–22 ; the first, spine-like seta on the lateral margin lies well apart from the second, long seta : these 2 setae extremely close to one another in *bisignatus* (Nitzsch) ; the laterally

placed setae widely separated compared to those on posterior margin, which are somewhat closely set ; the 2 median setae long and stout, unlike *plataleae*. Mesosternum always with 2 short, hyaline setae ; metasternum normally with 2 long setae, but 1 specimen had 2 each side.



FIGS. 1–3.—*Ibidoecus dennelli* sp. n. : (1) Male head ; (2) terminal segments of male abdomen ; (3) male genitalia.

Abdomen rounded. Tergal plates on segments II–VIII typical ; triangular and widely separated ; those on segments IX–X different in shape, but also widely separated. Tergal plates on segment II have weakly sclerotised sclerites associated with their anterior margins which in all probability represent the feebly sclerotised anterior margin of the tergal plate but could well be an independent sclerotisation. Anterior margin of tergites on segments, III–VIII also feebly sclerotised but, unlike *clausus*, the characteristic heavily sclerotised bar which separates a narrow anterior strip from the tergite proper not visible in unstained specimens ; in all probability it is present, since it is delineable in a female stained with carbol-fuchsin, but long treatment with potash has destroyed its identity.

Terminal segment XI differs greatly from that in *plataleae* ; it is emarginate, each lobe being broadly rounded. Tergites thereon in the form of triangular plates, not covering the greater part of the segment as in *clausus*. A large number of setae present on posterolateral and posterior margins so that the 3 anal setae cannot be delineated.

Sternal plates on segment II in the form of laterally placed, heavily sclerotised and pigmented transverse sclerites extending to lateral margin of segment each side, and slightly dorsolaterally also; sternites on segments III–VI laterally placed circular or elliptical plates, while those on segment VII are large triangular plates each with a blunt apex, unlike *clausus* in which this particular sternal thickening is in the form of a median, heavily sclerotised and pigmented plate.

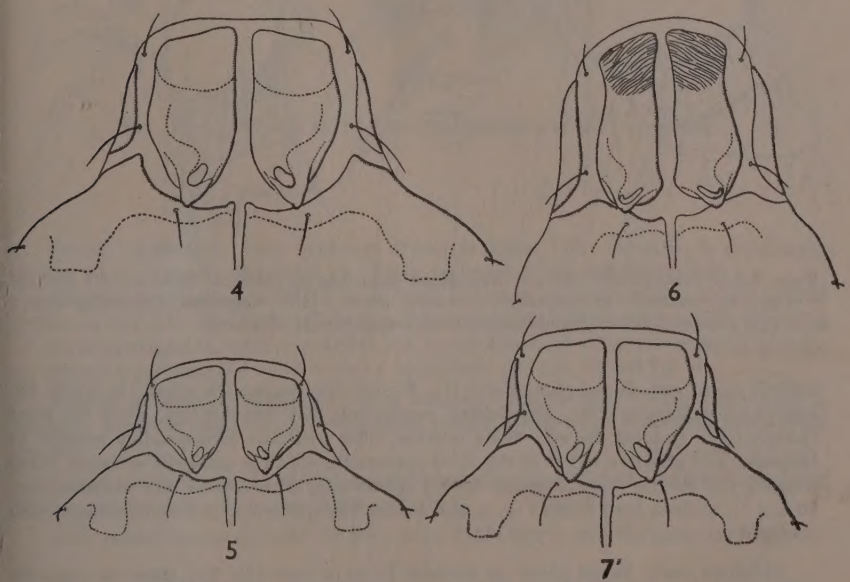
Number of setae on dorsum far greater than in *clausus*; segment II with 2 anterior tergocentral setae and 2 or more rows in middle of segment but posterior to the tergal plate only 1 row tends to be retained; segment III like II in arrangement of setae, but without the 2 tergocentral setae; segments IV–VIII with only 1 continuous row of a fairly large number of setae.

Postspiracular setae begin from segment III; as the row of tergal setae extends on each side well below the tergites, the postspiracular setae in segment IV and thereafter cannot be distinguished; segment VII also bears, like VIII, the typical seta lying each side in the pocket of the integument (Clay, 1955).

Sternal chaetotaxy with variation shown in Table II; chaetotaxy of sterna II–VI very similar to *clausus*; the 2 setae on sternum II minute, those on others long; sternum VII with 6–8 setae and the lateral edge of sternum IX normally with 3, occasionally only 2, spine-like setae.

Shape of posterior segments of abdomen, their chaetotaxy and genital plate as shown in fig. 2. A large number of setae, approximately 13, present on genital region each side of genital plate.

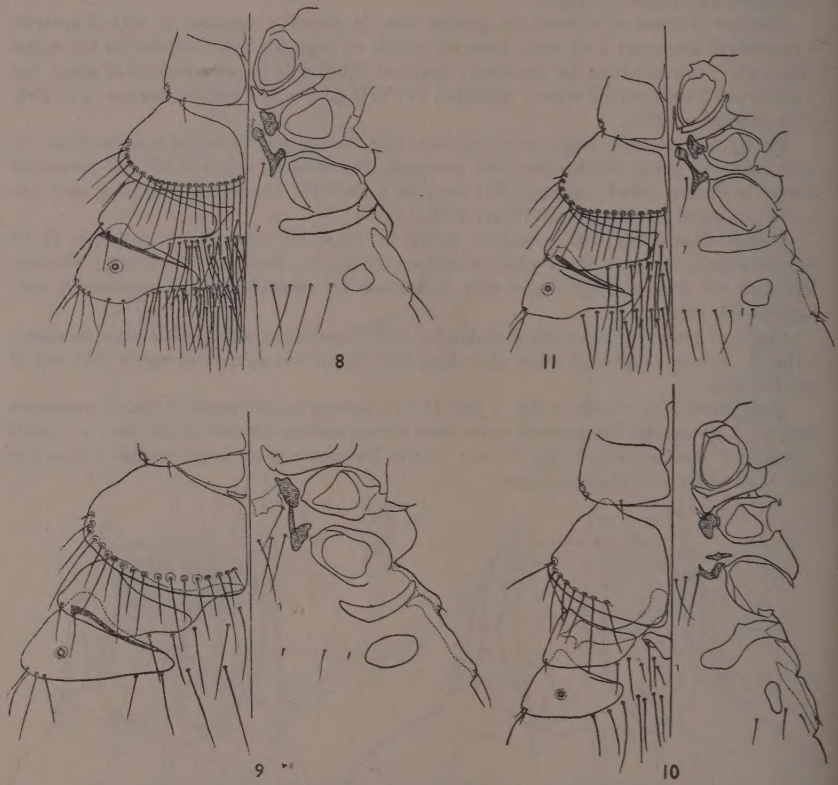
Male genitalia as shown in figs. 3 and 17; parameres do not reach to end of mesosome and the 3 mesosomal components differ from corresponding sclerites of *clausus*; a typical "median" sclerite present (fig. 3, *m*); unlike *bisignatus* there is no sclerite connecting the basal plate with the mesosome.



FIGS. 4–7.—Heads of female species of *Ibidoecus*: (4) *dennelli* sp. n.; (5) *plataleae* (Denny); (6) *bisignatus* (Nitzsch); (7) *clausus* (Giebel).

Female.—General characters of head and thorax similar to male, but slightly larger in size (fig. 4, Tables V and VII).

Dorsal marginal pterothoracic setae vary between 19–23. Mesosternum with 2 short and metasternum with 2 long setae (fig. 8). Articulation of pterothoracic legs is alike in



FIGS. 8–11.—Thorax and anterior abdominal segments of *Ibidoecus* species: (8) *dennelli* sp. n., female; (9) *plataleae* (Denny), male; (10) *bisignatus* (Nitzsch), male; (11) *clausus* (Giebel), female (made from a specimen in clove oil).

dennelli sp. n. and *clausus* (figs. 8 and 11). Second episternum, the sclerite to which the coxal base articulates (Clay, *unpublished manuscript*), flat and leaf-like, while the third episternum is hammer-shaped; these sclerites differ from the corresponding sclerites in *bisignatus* and *plataleae* but it is the third episternum which is markedly different, being a small, flat sclerite resembling the second episternum, in *bisignatus* and *plataleae* (figs. 10 and 9), while in both *dennelli* sp. n. and *clausus* the episternum is hammer-shaped with a winged proximal end (figs. 8 and 11).

Abdomen oval. Tergal plates on segment II as in male (fig. 8); those on segments III–VIII also as in male but with a heavily sclerotised bar demarcating a narrow strip anteriorly from the tergite proper. Sternites in segments II–VII as in male; the inner

margins of the large, triangular sternites on segment VII not joined to the genital plate, as in *plataleae*. Number of setae on dorsum far greater than in *clausus*; arrangement of setae on segments II–III as in male but the number in each row greater; segments IV–VIII also with more than 1 row of setae in middle of segment, though laterally, posterior to the tergal plate, only 1 row tends to be retained. Terminal abdominal segments (IX–XI) with either 3 or 4 long setae each side on dorsolateral margin and 4 tergocentral setae (only 1 specimen out of 7 had only 2 setae), not placed on the tergites, 2 or more of which always extend beyond posterior margin of abdomen. In *clausus* there are only 2 tergocentral setae placed similarly, and normally not reaching posterior margin of abdomen, occasionally reaching it, but never extending beyond it. Postspiracular setae difficult to distinguish from tergal setae, but probably begin from segment III.

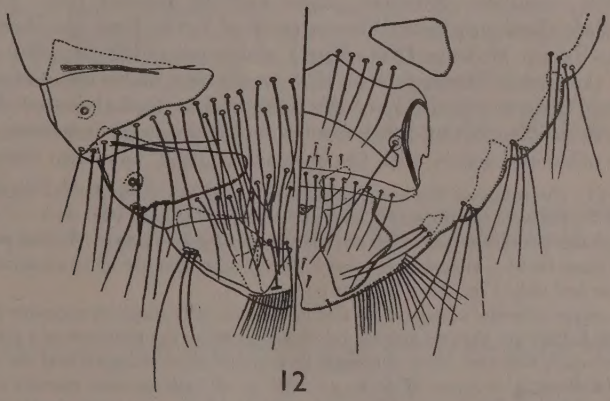


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FIG. 12.—*I. dennelli* sp. n.: terminal segments of female abdomen.

Sternal chaetotaxy with variation shown in Table III; normally 3, occasionally 2, 4 or 5 long inwardly directed setae present each side of last sternite (fig. 12).

Chaetotaxy of segments II–III as in figure 8, and of posterior segments and genital region as in figure 12. Genital plate broadly rectangular; sclerites supporting the vulva on the sides elongated, more or less oval, and characteristically thickened, differing from the structures supporting the vulva laterally in *plataleae* (cf. figs. 12 and 26).

Number of setae on margin of vulva between 15–21 (mostly 17–20), fewer than in *clausus*; the short thorn-like setae on ventral surface of vulva also fewer than in the latter species.

A characteristic, butterfly-shaped postvulval sclerite, with oblique thickening and another sclerite present each side in this region (fig. 13).

Body measurements of types (in mm.) as in Table I.

The species has been named in honour of Professor R. Dennell of the Zoological Laboratories, University of Manchester.

TABLE I.—Ibidoecus dennelli *sp. n. Measurements (in mm.) of types in Canada balsam.*

	Male		Female	
	Length	Breadth	Length	Breadth
Head . .	0·96	1·04	1·08	1·24
Prothorax .	0·25	0·64	0·27	0·75
Pterothorax .	0·42	1·004	0·48	1·19
Abdomen .	1·41	1·56	2·10	1·86
Total .	3·05	.	3·93	.

(2) *Ibidoecus clausus* (Giebel), 1874. (Figs. 7, 11, 14–16, 18)

Type host: *Threskiornis melanocephala* (Latham).

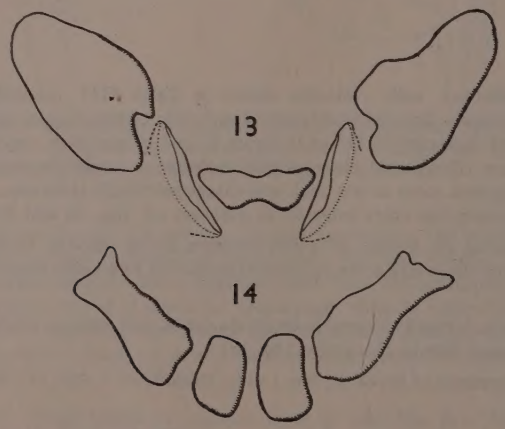
Material examined.—Nineteen males and 16 females from *Threskiornis melanocephala* (Latham) from different parts of India, from the Meinertzhagen collection, British Museum (Nat. Hist.), slides nos. 8720–22, 8881 and 8882, and from the British Museum (Nat. Hist.) collection, slides nos. 444 and 619.

In broad general characters of the head, thorax and abdomen this species resembles *dennelli* sp. n. but differs from it in the following characters. Wherever necessary other characters, with the normal variation, have also been included.

Male.—(1) The shape of the head, in both the pre- and postantennal regions; this is reflected in the shape of the dorsal anterior plates (Tables IV and VI).

(2) The 2 mesosternal setae, which are slightly stouter and longer. (Dorsal pterothoracic setae vary from 16–21; metasternal setae 2, only 1 specimen out of 18 examined showed 2 setae on one and only 1 on the other side.)

(3) The shape of tergal plates on the abdomen, especially those on segments III and XI; those on the former are slightly more pointed and those on the latter cover a greater part of the segment each side and have considerably rounded inner margins and are close to one another. (Abdominal tergites II as in *dennelli* sp. n. but anterior margin of secondary sclerite heavily sclerotised and pigmented. Tergal plates on segments III–VIII with a



FIGS. 13–14.—Postvulval sclerites in the female genital region of *Ibidoecus* species (drawn to same scale): (13) *dennelli* sp. n.; (14) *clausus* (Giebel).

narrow anterior part demarcated from the tergite proper by a heavily sclerotised and pigmented bar ; this bar appears as an intertergital sclerite each side, but careful examination reveals its true relation with the tergal plate.)

(4) The dorsal abdominal chaetotaxy, which is very sparse. Segment II has 2 anterior tergocentral setae and only 1 posterior row in the middle of the segment consisting of 11–16 setae. The chaetotaxy of the middle region of other segments is as follows :

III, 6–13 ; IV, 6–9 ; V, 5–7 ; VI, 2–5 ; VII–VIII, 2–3. (Besides the row of setae, segments IV–VI have 1 seta each side posterior to the tergal plate but even though these setae are separated by a gap from the outermost seta of the tergal row they do not lie in the postspiracular position (Clay, 1955). Segment VII usually bears in this position 2 setae, occasionally 1 seta, each side, while on segment VIII the normal number is 2, though occasionally there may be 1 or 3. These setae have been referred to as postspiracular setae in this communication.) Postspiracular setae begin from segment IV or V, rarely from VI also. Variation of ventral chaetotaxy shown in Table II ; it is slightly different from that of *dennelli* sp. n., for instance sternum VII normally with 4 long setae, occasionally 3 or 5 but never more ; in *dennelli* sp. n. the number varies between 6–8. (Sternum IX normally with 2, occasionally 1, rarely 3, spine-like setae on the lateral edge.)

(5) The sternal thickening on segment VII, which is in the form of a median plate (fig. 15), prominent in the middle due to heavy sclerotisation and pigmentation.

(6) The characters of the male genitalia (fig. 16). The mesosome is distinctly shorter than the parameres ; the mesosomal components and the median sclerite are of different shape and size.

Female.—(1) As for male (fig. 7).

(2) As for male (fig. 11). (Dorsal marginal pterothoracic setae vary between 17–22. Metasternal setae 2 ; 3 specimens, however, had 2 setae on one and 1 on the other side.)

TABLE II.—*Sternal chaetotaxy of males of species of* Ibidoecus

	dennelli sp. n. (6)*		*clausus* (15)*		*plataleae* (10)*	
	Each side	Total	Each side	Total	Each side	Total
II	1	2	1	2†	1	2
III	3–6	7–12	4–7	9–14	2–3	4–6
IV	4–6	8–12	4–6	8–12	2–4	5–7
V	3–6	7–11	3–5 (7, 6)‡	8–9 (13)	2–4	5–8
VI	3–5	7–10	2–5 (2, 2)‡	6–9 (4)	3–4	6–8
VII	3–4	6–8	2–3 (1, 2)‡	4–5 (3)	3–4 (2)‡	6–8 (4)
VIII	1	2	1	2	1	2

* Number of specimens examined.

† One specimen had a long seta on one side, near the margin of the segment.

‡ Exceptional specimens, in which the number did not fall in the normal range of variation.

(3) Same as for male for segment III (fig. 11).

(4) The dorsal abdominal chaetotaxy, which is sparse. (Segment II with 2 anterior tergocentral setae ; in the middle of this segment, and also of segment III there may be either 1 or 2 rows of setae ; segments IV–VIII with only 1 continuous row of setae ; number

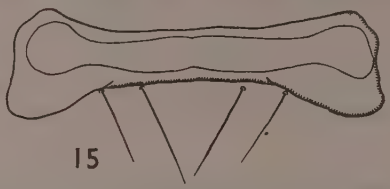
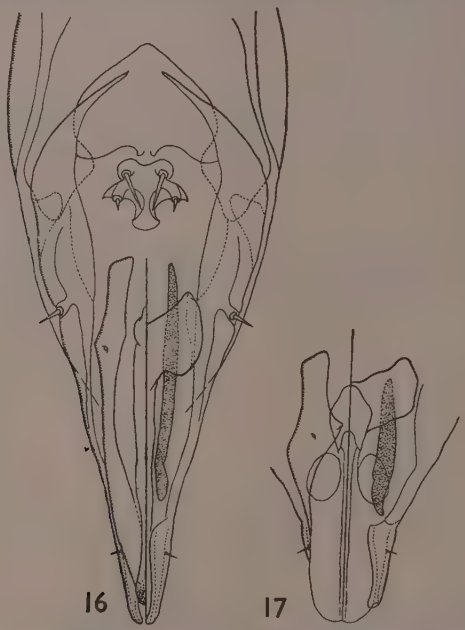


FIG. 15.—*I. clausus* (Giebel) : sternal thickening on segment VII of male abdomen.

of tergal setae on segment VIII considerably less.) Postspiracular setae begin from segment IV or V, occasionally present on segment III but on one side only. Terminal segments (IX–XI) always with 2 tergocentral setae (fig. 18) ; *dennelli* sp. n. normally with 4, and in both these species the setae are not placed on the tergite, unlike *bisignatus* (Nitzsch).



FIGS. 16–17.—Distal parts of male genitalia of *Ibidoecus* species (drawn to same scale): (16) *clausus* (Giebel) ; (17) *dennelli* sp. n.

Sternal chaetotaxy, with variation, shown in Table III. (On each side of the last sternite there are normally 2, occasionally 1 or 3, long inwardly directed setae.)

(5) The number of setae on the margin of the vulva, which varies between 22–28 (usually 24–27), is more than in *dennelli* sp. n., and so are the thorn-like setae on the ventral surface of the vulva.

(6) The shape of the postvulval sclerites in the genital region (fig. 14).

TABLE III.—*Sternal chaetotaxy of females of species of* Ibidoecus

	dennelli sp. n. (7)*		*clausus* (7)*		*plataleae* (7)*	
	Each side	Total	Each side	Total	Each side	Total
II .	1	2	1	2	1	2
III .	5–7	10–14	5–7	10–13	3–4	6–8
IV .	5–8	11–15	4–8	9–15	3–5	6–9
V .	5–8	11–16	5–8	10–15	3–5	7–9
VI .	4–7	9–13	4–6	8–12	3–5	7–9
VII .	3–6	7–11	3–5	8–10	3–5	6–9
VIII .	1	2	1	2	1	2

* Number of specimens examined.

Ibidoecus robustus Qadri, 1935

It has not been possible to identify this species with certainty as the original description and figures are deficient in certain specific characters and might apply to more than one species. The species was erected on the basis of a single female collected from an unidentified water-bird. Hopkins and Clay (1952) considered either *T. melanocephala* (Latham), *P. falcinellus* (Linn.) or *P. l. major* (Temminck and Schlegel) to be the likely hosts, but *Ibidoecus* from these hosts are distinct and differ greatly from *robustus* as figured by Qadri. Its greatest resemblance is to *I. clausus* parasitic on *T. melanocephala* and *I. dennelli* on *P. papillosa* (Temminck), and one of these is undoubtedly its true host; it appears to resemble *clausus* in the sparse abdominal chaetotaxy more than *dennelli*. A request was made to Dr. M. A. H. Qadri for the loan of the type-slide, for comparing the holotype with authentic material from these ibises. The slide, however, was not forthcoming and the conclusion that it has been lost is inescapable.

In the absence of the type material and as the original description and figure appear to resemble more closely *clausus* than any other species from Indian ibises, it has been decided to make *I. robustus* Qadri a synonym of *I. clausus* (Giebel) **(syn. n.)**.

(3) *Ibidoecus bisignatus* (Nitzsch), 1866. (Figs. 6, 10, 19–21)

Type host: *Plegadis f. falcinellus* (Linn.).

Of the four species considered here this is the only form in which the anterior one-third (approximately) of the dorsal anterior plates has oblique, parallel thickenings.

Material examined.—Eight males and two females from *Plegadis f. falcinellus* (L.) from Egypt, from the Meinertzhagen collection, British Museum (Nat. Hist.), slide no. 7999, and two males and one female from *P. f. falcinellus* (L.) from Bechuanaland, from F. Zumpt collection, British Museum (Nat. Hist.), slide no. 457.

TABLE IV.—*Breadth (in mm.) of head at temples of males of species of* Ibidoecus *with number of specimens*

	0·74	0·77	0·79	0·80	0·82	0·84	0·86	0·89	0·91	0·92	0·93	0·94
bisignatus (10)	2	5	2	.	1	.	.	.	.	.	.	.
clausus (18)	.	.	.	.	.	.	.	.	1	.	1	1
dennelli sp n. (6)	.	.	.	.	.	.	.	.	.	.	.	.
plataleae (10)	.	.	.	1	.	.	2	1	3	1	1	.

	0·95	0·96	0·97	0·98	0·99	1·00	1·01	1·02	1·03	1·04	1·06	1·11
bisignatus (10)	.	.	.	.	.	.	.	.	.	.	.	.
clausus (18)	1	.	1	4	1	2	2	3	.	.	1	.
dennelli sp. n. (6)	.	.	.	.	.	.	.	.	1	2	1	2
plataleae (10)	.	1	.	.	.	.	.	.	.	.	.	.

TABLE V.—*Breadth (in mm.) of head at temples of females of species of* Ibidoecus *with number of specimens*

	0·87	0·88	0·99	1·01	1·05	1·06	1·07	1·09	1·10	1·11	1·13	1·14	1·15
bisignatus (2)	1	1	.	.	.	.	.	.	.	.	.	.	.
clausus (16)	.	.	.	.	.	2	.	.	1	2	1	3	2
dennelli sp. n. (7)	.	.	.	.	.	.	.	.	.	.	.	.	.
plataleae (13)	.	.	2	1	4	.	1	1	2	1	1	.	.

	1·16	1·17	1·18	1·21	1·22	1·24	1·26	1·27	1·29	1·30	1·32	1·34
bisignatus (2)	.	.	.	.	.	.	.	.	.	.	.	.
clausus (16)	2	1	2	.	.	.	.	.	.	.	.	.
dennelli sp. n. (7)	.	.	.	1	1	4	.	1	.	.	.	.
plataleae (13)	.	.	.	.	.	.	.	.	.	.	.	.

TABLE VI.—*Cephalic index of males of species of* Ibidoecus *with number of specimens*

	0·89	0·90	0·91	0·92	0·93	1·07	1·08	1·09	1·10	1·11	1·12	1·14	1·15
bisignatus (10)	3	3	1	2	1	.	.	.	.	.	.	.	.
clausus (18)	.	.	.	.	.	1	.	.	1	.	1	3	2
dennelli sp. n. (6)	.	.	.	.	.	.	1	2	2	1	.	.	.
plataleae (9)	.	.	.	.	.	.	.	.	.	.	.	.	.

	1·16	1·17	1·18	1·19	1·21	1·23	1·24	1·25	1·26	1·27	1·28	1·29	1·31
bisignatus (10)	.	.	.	.	.	.	.	.	.	.	.	.	.
clausus (18)	1	3	2	1	.	.	1	.	.	.	.	2	.
dennelli sp. n. (6)	.	.	.	.	.	.	.	.	.	.	.	.	.
plataleae (9)	.	.	.	.	1	1	.	1	1	1	2	1	1

TABLE VII.—*Cephalic index of females of species of* Ibidoecus *with number of specimens*

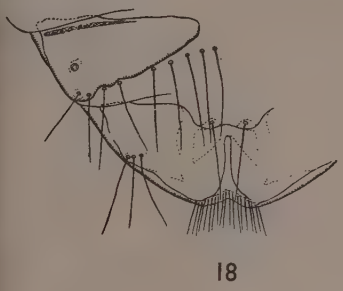
	0·90	0·93	1·10	1·11	1·12	1·13	1·14	1·15	1·16	1·17	1·18
bisignatus (2)	1	1	.	.	.	.	.	.	.	.	.
clausus (16)	.	.	1	2	.	2	3	2	3	.	1
dennelli sp. n. (7)	.	.	.	.	1	.	3	1	.	1	.
plataleae (13)	.	.	.	.	.	.	.	.	.	.	.

	1·19	1·20	1·22	1·23	1·24	1·25	1·26	1·29	1·31	1·33	1·35
bisignatus (2)	.	.	.	.	.	.	.	.	.	.	.
clausus (16)	.	.	2	.	.	.	.	.	.	.	.
dennelli sp. n. (7)	.	.	.	.	1	.	.	.	.	.	.
plataleae (13)	.	1	.	2	1	3	2	1	1	1	1

Head longer than wide ; the pre-antennal region elongated and slightly longer than the postantennal region, consequently the dorsal anterior plates are proportionately longer (fig. 6). Width across the temples given in Tables IV and V. C.I. 0·89–0·93 in the male and 0·90 and 0·93 in the two females (Tables VI and VII).

Prothorax as in *dennelli* sp. n., with slight differences in the shape of internal sclerites. Pterothorax different from *dennelli* sp. n.; dorsal marginal setae not extending to mid-line (fig. 10), varying between 9–11 each side in the 2 sexes. The first short and the second long setae on the lateral margins close together, unlike the other 3 species. Mesosternum devoid of setae ; metasternum with 4–8 setae in the male and the three females had 3 + 3, 3 + 3 and 2 + 3 setae.

General characters of abdomen as in *dennelli* sp. n. with slight differences in the shape of the tergites, sternites and the dorsal and ventral chaetotaxy.



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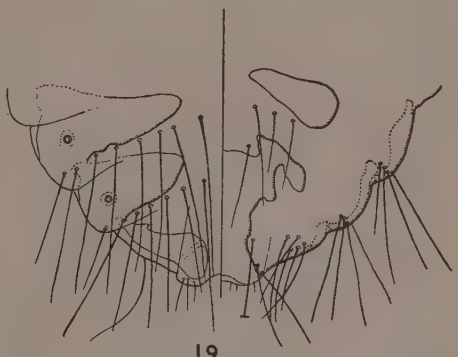

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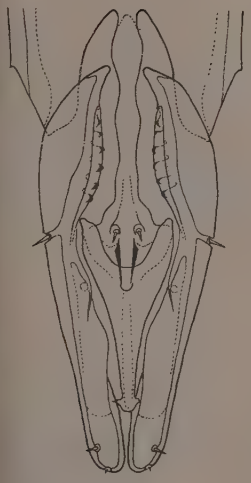

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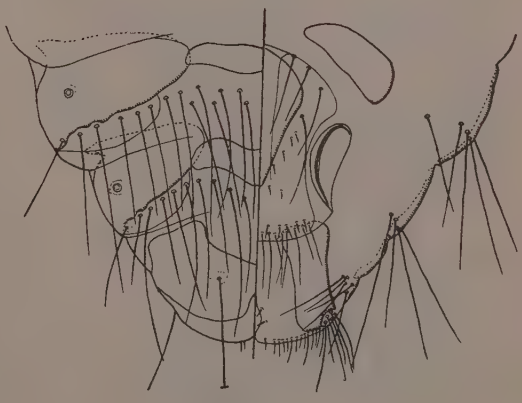

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FIGS. 18–21.—(18) *I. clausus* (Giebel) : terminal segments of female abdomen, dorsal; (19–21) *I. bisignatus* (Nitzsch) : (19) terminal segments of male abdomen ; (20) male genitalia, distal part only ; (21) terminal segments of female abdomen.

In the key to the species of *Ibidoecus*, Carriker (1947) has separated this from the remaining species on the character of the pleurites. Unfortunately it has not been possible to study this character because in potash-treated specimens the pleurites are hardly delineable, even after staining with carbol-fuchsin.

Abdominal segment II characteristic ; anterior margin of tergal plates thickened, the thickening extending into the pterothorax where it fuses with the pteronotum ; a small sclerite present in about the middle of the segment each side, the sclerites of the 2 sides either separate or fused (fig. 10). The 2 anterior tergocentral setae on segment II either present on or off these sclerites. In the female, segments III and VI–VIII also bear a median sclerite ; that on segment III faint and inconspicuous while those on VI–VIII are heavily sclerotised, pigmented and prominent. (All the females, apparently, do not possess the median sclerites in segments VI–VIII ; one, out of 3 examined, lacked these although fully mature. Figure 21 has been drawn from this particular specimen and the median thickenings have been included to indicate their position when present.) Mesially the sternal thickening on segment II is bent towards the posterior end of the body (fig. 10) ; sternites on segments III–VI longitudinally elliptical, laterally placed plates. Segments II–III without post-spiracular setae.

Male.—Abdominal chaetotaxy of segments II–III and posterior segments of abdomen as in figures 10 and 19. Number of setae on sterna VII and VIII varies, either 3 + 3, 2 + 3 or 2 + 2 setae on the former, and either 1 + 1, 1 + 2 or 2 + 2 setae on the latter. Segment IX has 1 marginal seta, shown on the dorsal side in figure 19, and generally 3–5 long setae on the lateral edge of the sternum—rarely 2 or even as many as 6–7. The 3 setae on the posterolateral margin of the terminal segment are probably the anal setae.

Genital plate and male genitalia as in figures 19 and 20. The genitalia differ from those of *dennelli* sp. n. and *clausus* in the shape of the parameres, which are not pointed at the tips, and in possessing a median sclerite which joins the basal plate with the mesosome.

Female.—Shape of posterior segments of abdomen, their chaetotaxy and the genital region as in figure 21. The 3 dorsal setae near the outer margin, each side of segments IX–XI, present in *dennelli* sp. n. and in *clausus*, are absent ; only 1 seta present in this position, which is ventrolateral rather than dorsal ; the 2 tergocentral setae on these segments placed on the tergites, unlike *dennelli* sp. n. and *clausus*.

Sternite on terminal segments long ; 3–7 long, inwardly directed setae present on its outer margin and 4–6 stout setae on its posterolateral margin (fig. 21). Margin of vulva set with 2 rows of setae, a proximal row of 8–12 and a slightly distal row of 14–16 comparatively longer setae. No postvulval sclerites, similar to those present in the 2 previous species, present in the genital region.

(4) *Ibidoecus plataleae* (Denny), 1842. (Figs. 5, 9, 22–26)

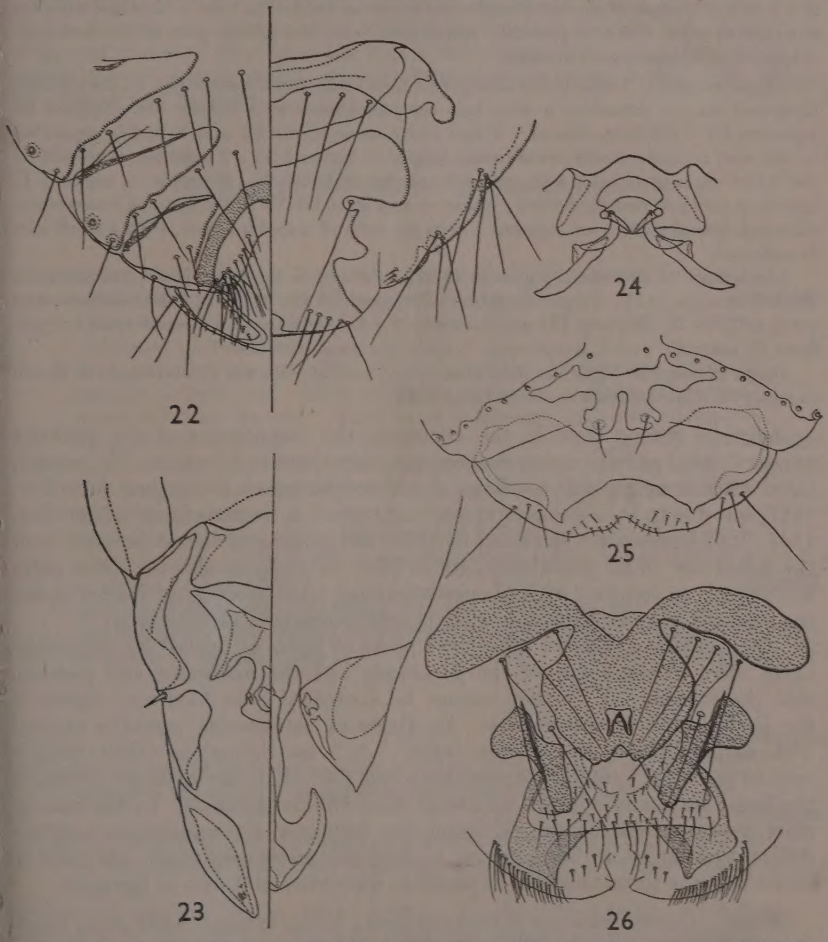
Type host : *Platalea l. leucorodia* L.

This species differs considerably from the three previous ones and forms a distinct, separable group with *flavus* and *iberoamericanus*.

The characters which distinguish it (and probably the group to which it belongs) from species parasitic on ibises are, in the male, the arrangement of the tergal plates on the terminal abdominal segment and, in the female, the inner margin of the sternite on segment VII, which is joined to the genital plate, and the shape and thickening of the sclerites which support the vulva laterally. Another character, but not as striking, is the sternal chaetotaxy of segments III and IV ; these segments have in both the sexes both short and

long setae, the former being always more numerous than the latter which are never more than two. In species parasitic on ibises these segments normally have long setae only.

Material examined.—Three males and four females from Rajputana, India (slide no. 19696, Meinertzhagen collection, British Museum (Nat. Hist.)), and one male and four females (slide no. 2814, Meinertzhagen collection) from Holland, from *Platalea l. leucorodia* Linn.; five males and four females (slide no. 17022, Meinertzhagen collection) from Sudan from *P. l. major* (Temminck and Schlegel), and three males and two females from U.P., India, from *P. l. leucorodia* L. (slide no. 619, British Museum (Nat. Hist.) collection).



FIGS. 22–26.—*I. plataleae* (Denny): (22) terminal segments of male abdomen; (23) male genitalia, distal part only; (24) sclerite "X", as it appears in normally retracted genitalia inside the abdomen; (25) terminal segments of female abdomen, dorsal (only alveoli of setae on segment VIII shown); (26) female genital region.

Male.—Shape of the head characteristic, being much wider than long on account of the short pre-antennal region as compared with the postantennal region; the latter with well rounded temples (Table IV). C.I. 1·21–1·31 (Table VI). Mandibles as admirably described by Cummings (1916).

Prothorax as in *dennelli* sp. n. with only minor differences in the shape of the various internal sclerites (fig. 9). Pterothorax also as in *dennelli*; 2 sclerites, a large and a small, present between pronotum and pteronotum each side (fig. 9); these are absent in the other 3 species. Dorsal marginal setae extend to the mid-line of the divided pteronotum and vary from 17–21 each side; 2 or 3 median setae, always short and not crossing posterior margin of pteronotum; the first short, spine-like and the second long setae on the lateral margins always well separated. Mesosternum always with 1 seta each side; metasternum with 3 + 3 or 3 + 2 setae. Both second and third episterna flat and leaf-like; the third with the recurved sclerite, which is probably homologous with the handle part of the hammer-shaped third episternum of *dennelli*.

Abdomen round. Tergal plates on segment II of characteristic shape (fig. 9), the anterior thickened margin extending a little into the pterothorax as a slender bar. Tergites on segments III–VIII as in *clausus*. Tergal plates on segments IX and X widely separated by the very typical anterior, semicircular tergite on segment XI; 2 more plates present on the latter segment, 1 each side, placed as shown in figure 22. Sternites on segment II heavily sclerotised and pigmented; those on segments III–VI in the form of transversely elliptical, lateral plates; on segment VII in the form of a median plate, with a small lobe at each end.

Chaetotaxy of abdominal segments II–III as shown in figure 9. Postspiracular setae begin from segment IV. Tergal chaetotaxy of segment XI as in figure 22. Sternal chaetotaxy given in Table II. Sternum VII normally with 6–8 long setae, only 1 specimen had 4; sternum IX normally with 3, occasionally 2, spine-like setae each side.

Shape of posterior segments, their chaetotaxy, genital plate and genital region as shown in figure 22. Male genitalia as shown in figure 23.

In their resting state in the abdomen, the components of the genitalia appear twisted and the structures, consequently, hard to interpret. The complicated nature attributed to them, for *iberoamericanus* (= *ajajus*) (Carriker, 1947) was due to their being retracted and tucked in because figure 2 (Carriker, 1947 : 120) represents a specimen in which the parameres almost certainly and the mesosome, in all probability, are twisted. In *platalеae* also the distal parts are difficult to compare with the corresponding sclerites of other species unless the genitalia are extruded,when they can be interpreted satisfactorily.

The genitalia appear to differ from those of *flavus* as figured by Cummings (1916 : 668) in the shape of the parameres and the mesosome and possibly also the sclerite "X"; they cannot be compared with Carriker's figure of the genitalia of *iberoamericanus*. In dissected, unmounted genitalia stained with carbol-fuchsin, the sclerite called "X" by Cummings (1916 : 669) is seen to lie on the ventral side opposite to the flat, plate-like distal projection of the basal plate and appears somewhat as shown in figure 23. In the natural state, however, when retracted inside the abdomen, the appearance becomes different owing to its being folded so that the structures which are distal in figure 23 come to be proximal in position, somewhat as shown in figure 24.

Female.—General characters of head and thorax similar to male; width across temple given in Table V. C.I. 1·20–1·35 (Table VII). Pterothorax with 16–21 dorsal marginal setae each side; 2 median setae are long and cross the posterior pterothoracic margin into the abdomen. Mesosternum with 1 seta each side (1 had 0 + 1 only); metasternum with either 3 + 3, 2 + 3 or 2 + 2 setae.

Abdomen oval; tergites on segment II differ only slightly from the male; terminal segments with tergal plates continuous across the segment, differing in shape from the other 3 species. Some females show an irregularly sclerotised patch on the tergum, between the tergal plates on segment VIII and the terminal segments (fig. 25). Sternites on segments II and IV–VI as in male; on segment III as circular plates; inner margin of sternite VII, each side, joined to central, ventral portion of genital plate (fig. 26).

Number of setae on dorsum slightly greater than in male; 2 tergocentral setae on terminal segments, not placed on the tergites. Number of setae on sternum VII varies between 3–5 each side. The long inwardly directed setae on the last sternum, present in the preceding species, absent.

Genital region as in figure 26. Central portion of genital plate, which is globular in shape and ventral in position, more heavily sclerotised and pigmented than surrounding dorsal region. Lateroventral sclerites which reinforce the vulva on the sides differ markedly in shape and manner of their thickening from lateral sclerites of the 3 foregoing species (cf. figures 12 and 21 with figure 26). A small subvulval sclerite present in this region. Margin of vulva set with 10–16 setae.

IV. Key to the Indian Species of *Ibidoecus*

Males

1 Anterior tergal plate on terminal segment of abdomen in the form of a semicircular, heavily sclerotised sclerite (fig. 22) . . . . **plataleae**

– Tergites on terminal abdominal segment (XI) not as above, but as triangular plates (fig. 2) 2

2 Dorsal anterior plates with oblique, parallel thickenings apically (similar to figure 6). (Male genitalia as shown in figure 20; parameres stout at the tips; basal plate connected with the mesosome by a median sclerite) . . . . . **bisignatus**

– Dorsal anterior plates without oblique thickenings apically (fig. 1). (Parameres bluntly pointed at the tips; basal plate not connected with the mesosome) 3

3 Sternal thickening on abdominal segment VII in the form of a median plate (fig. 15). (Dorsal abdominal chaetotaxy sparse; male genitalia as shown in figure 16) . . . . . **clausus**

– Sternal thickening on abdominal segment VII in the form of lateral plates (fig. 2). (Dorsal abdominal chaetotaxy dense; male genitalia as shown in figures 3 and 17) . . . . . **dennelli** sp. n.

Females

1 Inner margin of each lateral sternal plate on abdominal segment VII joined to the central, globular portion of the genital plate (fig. 26) **plataleae**

– Inner margins of sternal plates on abdominal segment VII not joined to the genital plate, but sternites as separate, triangular plates (fig. 12) 2

2 Dorsal anterior plates with oblique, parallel thickenings apically (fig. 6). (Terminal abdominal segments without 3 dorsal, marginal setae each side, figure 21) . . . . . **bisignatus**

– Dorsal anterior plates without oblique, parallel thickenings apically (fig. 4). (Terminal abdominal segments with 3 dorsal, marginal

setae each side, figure 12) 3

3 Genital region with small thickening in the form of 2 separate, rectangular sclerites and additional sclerites each side (fig. 14). Number of setae on margin of vulva 22–28. (Abdominal segments IV–VIII with 1 row of tergal setae) . . . . . **clausus**

– Genital region with small thickening in the form of a butterfly-shaped sclerite and additional sclerites each side (fig. 13). Number of setae on margin of vulva 15–21. (Abdominal segments IV–VIII with more than 1 row of tergal setae) . . . . . **dennelli** sp. n.

V. Summary

Four species of *Ibidoecus* occurring on Indian ibises (family Threskiornithidae) have been reported. Of these, *dennelli* sp. n. from *Pseudibis papillosa* has been described in full and the remaining three, *clausus* (Giebel), *bisignatus* (Nitzsch) and *plataleae* (Denny), have been redescribed. In addition one species, *Ibidoecus robustus* Qadri, was described without host and has here been placed as a synonym of *I. clausus* (Giebel). Some remarks on differences between *plataleae*, a parasite of the spoonbill (subfamily Plataleinae), and the remaining species, all from ibises (subfamily Threskiornithinae), are included. A key to these species is given.

VI. References

Carriker, M. A., 1947, Neotropical Mallophaga Miscellany. No. 2. The genus *Ibidoecus* Cummings. *Bol. Ent. Venez.* **6** : 111–36.

Clay, T., 1955, The post-spiracular seta and sensillus in the Mallophaga (Insecta). *Ann. Mag. nat. Hist.* (12) **7** : 716–8.

Cummings, B. F., 1916, Studies on the Anoplura and Mallophaga, being a report upon a collection from the mammals and birds in the society's gardens. Part II. *Proc. zool. Soc. Lond.* **1916** : 643–93.

Eichler, W., 1943, Notulae Mallophagologicae. VI. Über acht meist neue Federlingsarten aus Sudamerika. *Mem. Estud. zool. Mus. Univ. Coimbra* **140** : 1–7.

Hopkins, G. H. E. and Clay, T., 1952, *A Check List of the Genera and Species of Mallophaga.* London.

Qadri, M. A. H., 1935, Studies on the Mallophaga of North-Indian birds. *Z. Parasitenk.* **8** : 226–38